Chapter 5

Example Application of Rapid Visual Screening

Presented in this chapter is an illustrative application of the rapid visual screening procedure in the hypothetical community of Anyplace USA. The RVS implementation process (as depicted in Figure 2-1) is described, from budget development to selection of the appropriate Data Collection Form, to the screening of individual buildings in the field. Prior to implementation of the RVS procedure, the RVS authority (the Building and Planning Department of Anyplace) has reviewed the *Handbook* and established the purpose for the RVS.

5.1 Step 1: Budget and Cost Estimation

The RVS authority has been instructed by the city council to conduct the RVS process to identify all buildings in the city, excluding detached single-family and two-family dwellings, that are potentially earthquake hazardous and that should be further evaluated by a design professional experienced in seismic design (the principal purpose of the RVS procedure). It is understood that, depending on the results of the RVS, the city council may adopt future ordinances that establish policy on when, how and by whom low-scoring buildings should be evaluated and on future seismic rehabilitation requirements. It is also desired that the results from the RVS be incorporated in the geographic information system that the city recently installed to map and describe facilities throughout the city, including all buildings and utility systems within the city limits.

The RVS authority has determined there are approximately 1,000 buildings in the city that are not detached single-family or two-family dwellings and that some of the buildings are at least 100 years old. The RVS authority plans (1) to conduct a pre-field data collection and evaluation process to examine and assess information in its existing files and to document building location, size, use, and other information on the Data Collection Forms prior to field screening; (2) to review available building plans prior to field screening; (3) to inspect the interiors of buildings whenever possible; (4) to establish an electronic RVS record-keeping system that is compatible with its GIS; and (5) to train screeners prior to sending them into the field.

Costs to conduct these activities have been estimated, assuming an average of $40 per hour (salary plus benefits) for personnel who perform data evaluation, screening, and record management. Costs are in 2001 dollars. It is assumed that three persons will carry out the pre-field data collection and evaluation process, that four two-person teams of design professionals will conduct the review of building plans and the field screening, that two persons will file all screening data, and that the entire RVS process will take approximately six months. Based on these rates and assumed times to conduct the various activities, the following RVS budget has been established:

1.	Pre-field data collection, evaluation, and processing (1,000 buildings × 0.4 hr/building × $40/hr)	$16,000
2.	Training, including trainer time (24 hours), screener time (8 hours per screener), and materials	4,000
3.	Review of available building plans (500 plan sets × 0.75 hr/plan set × $40/hr)	15,000
4.	Field screening (1,000 buildings × 0.75 hr/building × $40/hr)	30,000
5.	Record-keeping system development	5,000
6.	Electronic filing of Data Collection Forms, including verification of data input (1,000 forms × 0.75 hour/form × $40/hour)	30,000
7.	Subtotal	$100,000
8.	Management (10% of item 7)	10,000
9.	Total	$110,000

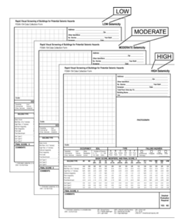
5.2 Step 2: Pre-Field Planning

During the pre-field planning process the RVS authority confirmed that the existing geographic information system was capable of being expanded to include RVS-related information and results. In addition, the RVS authority decided that sufficient soil information was available from the State Geologist to develop an overlay for their GIS containing soils information for the entire city. While not required as part of the RVS process, it was also determined that the city included an area that had isolated pockets of low liquefaction potential, and that there was no area with landslide potential. Consequently the RVS authority concluded that GIS overlays for liquefaction and landslide potential were not warranted.

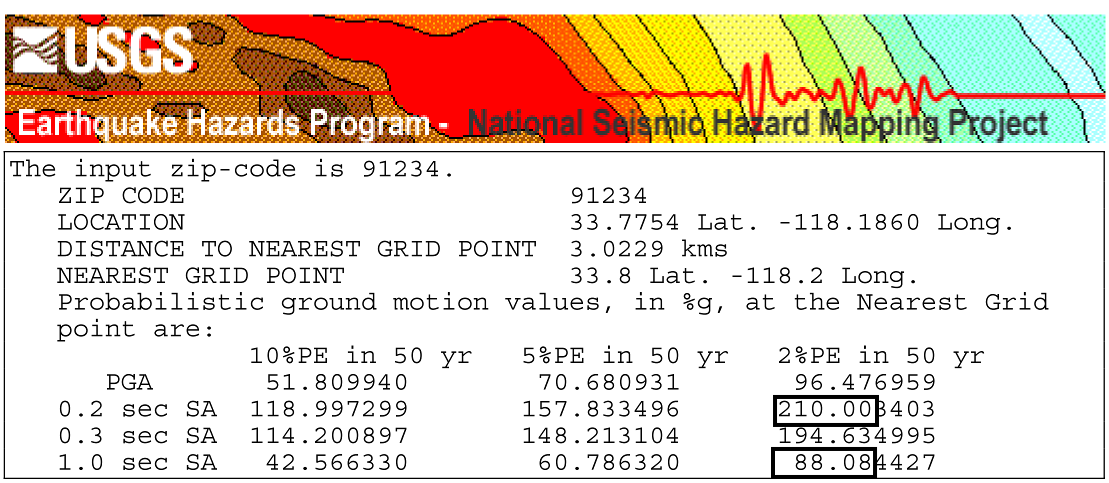
The RVS authority also verified that the existing GIS had reference tables containing address information for most of the properties in the city (developed earlier from the tax assessor's files) and that these tables could be extracted and included in a new GIS-compatible electronic relational database containing the RVS results. It was also determined that other building and planning department's files contained reliable information on building name, use, size (height and area), structural system, and age for buildings built or remodeled within the last 30 years, and that Sanborn maps, which contain size, age, and other building attribute information (see Section 2.6.3) were available (at the local library) for most of the downtown sector.

Based on this information, the RVS authority confirmed its prior preliminary decision under Step 1 to develop an electronic RVS record keeping system (relational database) that could be imported into the existing GIS. The RVS authority also decided to focus on the downtown sector of Anyplace during the initial phase of the RVS field work, and to expand to the outlying areas later.

5.3 Step 3: Selection and Review of the Data Collection Form



To choose the correct Data Collection Form, the RVS authority elected to establish the seismicity for Anyplace USA by using Method 2 (see Section 2.4.1), rather than by selecting the seismicity region from the maps in Appendix A. Method 2, using the zip-code option, provides more precision than the Appendix A maps which use county boundaries. Method 2 was executed by accessing the USGS seismic hazard web site (http://geohazards.cr.usgs.gov/eq/), selecting Hazard by Zip Code, entering the zip code, 91234, and obtaining spectral acceleration (SA) values for 0.2 second and 1.0 second for ground motions having a 2% probability of being exceeded in 50 years (see Figure 5-1). The values of 2.10 *g* and 0.88 *g* for 0.2 second and 1.0 second, respectively, were multiplied by 2/3 to obtain the reduced values of 1.40 *g* and 0.59 *g*, respectively, for 0.2




```
The input zip-code is 91234.
   ZIP CODE                        91234
   LOCATION                        33.7754 Lat. -118.1860 Long.
   DISTANCE TO NEAREST GRID POINT  3.0229 kms
   NEAREST GRID POINT              33.8 Lat. -118.2 Long.
   Probabilistic ground motion values, in %g, at the Nearest Grid
   point are:
               10%PE in 50 yr    5%PE in 50 yr    2%PE in 50 yr
      PGA       51.809940         70.680931        96.476959
   0.2 sec SA  118.997299        157.833496       210.003403
   0.3 sec SA  114.200897        148.213104       194.634995
   1.0 sec SA   42.566330         60.786320        88.084427
```

Figure 5-1 Screen capture of USGS web page showing SA values for 0.2 sec and 1.0 sec for ground motions having 2% probability of being exceeded in 50 years (values shown in boxes).

second and 1.0 second. These reduced values were compared to the criteria in Table 2-1 to determine that the reduced (using the 2/3 factor) USGS assigned motions met the "high seismicity" criteria for both short-period and long-period motions (that is, 1.40 *g* is greater than 0.5 *g* for the 0.2 second [short-period] motions, and 0.59 *g* is greater than 0.2 *g* for the 1.0 second [long-period] motions). All other zip codes in Anyplace were similarly input to the USGS web site, and the results indicated high seismicity in all cases. On this basis the RVS authority selected the Data Collection Form for high seismicity (Figure 5-2).

Using the checklist of Table 2-3, the RVS authority reviewed the Data Collection Form to determine if the occupancy categories and occupancy loads were useful for their purposes and evaluated other parameters on the form, deciding that no changes were needed. The RVS authority also conferred with the chief building official, the department's plan checkers, and local design professionals to establish key seismic code adoption dates for the various building lateral-load-resisting systems considered by the RVS and for anchorage of heavy cladding. It was determined that Anyplace adopted seismic codes for W1, W2, S1, S5, C1, C3, RM1, and RM2 building types in 1933, and that seismic codes were never adopted for URM buildings (after 1933 they were no longer permitted to be built). For S2, S3, S4 and PC2 buildings, it was assumed for purposes of the RVS procedure that seismic codes were adopted in 1941, using the default year recommended in Section 2.4.2. For PC1 buildings, it was assumed that seismic codes were first adopted in 1973 (per the guidance provided in Section 2.4.2). It was also determined that seismically rehabilitated URM buildings should be treated as buildings designed in accordance with a seismic code (that is, treated as if they were designed in 1933 or thereafter). Because Anyplace has been consistently adopting the *Uniform Building Code* since the early 1960s, benchmark years for all building types, except URM, were taken from the "UBC" column in Table 2-2. The year in which seismic anchorage requirements for heavy cladding was determined to be 1967. These findings were indicated on the Quick Reference Guide (See Figure 5-3).

5.4 Step 4: Qualifications and Training for Screeners

Anyplace USA selected RVS screeners from two sources: the staff of the Department of Building and Planning, and junior-level engineers from local engineering offices, who were hired on a temporary consulting basis. Training was carried out by one of the department's most experienced plan checkers, who spent approximately 24 hours reading the FEMA 154 *Handbook* and preparing training materials.

As recommended in this *Handbook*, the training was conducted in a classroom setting and consisted of: (1) discussions of lateral-force-resisting systems and how they behave when subjected to seismic loads; (2) how to use the Data Collection Form and the Quick Reference Guide; (3) a review of the Basic Structural Hazard Scores and Score Modifiers; (4) what to look for in the field; (5) how to account for uncertainty; and (6) an exercise in which screeners were shown interior and exterior photographs of buildings and asked to identify the lateral-load-resisting system and vertical and plan irregularities. The training class also included focused group interaction sessions, principally in relation to the identification of structural systems and irregularities using exterior and interior photographs. Screeners were also instructed on items to take into the field.

5.5 Step 5: Acquisition and Review of Pre-Field Data

As described in the Pre-Field Planning process (Step 2 above), the RVS authority of Anyplace USA already had electronic GIS reference tables containing street addresses and parcel numbers for most of the buildings in the city. These data (addresses and parcel numbers) were extracted from the electronic GIS system (see screen capture of GIS display showing parcel number and other available information for an example site, Figure 5-4) and imported into a standard off-the-shelf electronic database as a table. To facilitate later

Rapid Visual Screening of Buildings for Potential Seismic Hazards

FEMA-154 Data Collection Form

HIGH Seismicity

Address: ______________________________

______________________ **Zip** __________

Other Identifiers ______________________

No. Stories ________________ **Year Built** ________

Screener ________________ **Date** __________

Total Floor Area (sq. ft.) ______________________

Building Name ______________________

Use ______________________

Scale:

PHOTOGRAPH

OCCUPANCY			SOIL		TYPE						FALLING HAZARDS			
Assembly	Govt	Office	Number of Persons		A	B	C	D	E	F	☐	☐	☐	☐
Commercial	Historic	Residential	0 – 10	11 – 100	Hard Rock	Avg. Rock	Dense Soil	Stiff Soil	Soft Soil	Poor Soil	Unreinforced Chimneys	Parapets	Cladding	Other: ________
Emer. Services	Industrial	School	101-1000	1000+										

BASIC SCORE, MODIFIERS, AND FINAL SCORE, *S*

BUILDING TYPE	W1	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM
Basic Score	**4.4**	**3.8**	**2.8**	**3.0**	**3.2**	**2.8**	**2.0**	**2.5**	**2.8**	**1.6**	**2.6**	**2.4**	**2.8**	**2.8**	**1.8**
Mid Rise (4 to 7 stories)	N/A	N/A	+0.2	+0.4	N/A	+0.4	+0.4	+0.4	+0.4	+0.2	N/A	+0.2	+0.4	+0.4	0.0
High Rise (> 7 stories)	N/A	N/A	+0.6	+0.8	N/A	+0.8	+0.8	+0.6	+0.8	+0.3	N/A	+0.4	N/A	+0.6	N/A
Vertical Irregularity	-2.5	-2.0	-1.0	-1.5	N/A	-1.0	-1.0	-1.5	-1.0	-1.0	N/A	-1.0	-1.0	-1.0	-1.0
Plan irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Pre-Code	0.0	-1.0	-1.0	-0.8	-0.6	-0.8	-0.2	-1.2	-1.0	-0.2	-0.8	-0.8	-1.0	-0.8	-0.2
Post-Benchmark	+2.4	+2.4	+1.4	+1.4	N/A	+1.6	N/A	+1.4	+2.4	N/A	+2.4	N/A	+2.8	+2.6	N/A
Soil Type C	0.0	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Soil Type D	0.0	-0.8	-0.6	-0.6	-0.6	-0.6	-0.4	-0.6	-0.6	-0.4	-0.6	-0.6	-0.6	-0.6	-0.6
Soil Type E	0.0	-0.8	-1.2	-1.2	-1.0	-1.2	-0.8	-1.2	-0.8	-0.8	-0.4	-1.2	-0.4	-0.6	-0.8

FINAL SCORE, *S*

COMMENTS

Detailed Evaluation Required

YES NO

* = Estimated, subjective, or unreliable data
DNK = Do Not Know

BR = Braced frame
FD = Flexible diaphragm
LM = Light metal

MRF = Moment-resisting frame
RC = Reinforced concrete
RD = Rigid diaphragm

SW = Shear wall
TU = Tilt up
URM INF = Unreinforced masonry infill

Figure 5-2 High seismicity Data Collection Form selected for Anyplace, USA.

Rapid Visual Screening of Buildings for Potential Seismic Hazards (FEMA 154)
Quick Reference Guide (for use with Data Collection Form)

1. Model Building Types and Critical Code Adoption and Enforcement Dates

Structural Types		**Year Seismic Codes Initially Adopted and Enforced***	**Benchmark Year when Codes Improved**
W1	Light wood frame, residential or commercial, ≤ 5000 square feet	1933	1976
W2	Wood frame buildings, > 5000 square feet.	1933	1976
S1	Steel moment-resisting frame	1933	1994
S2	Steel braced frame	1941	1988
S3	Light metal frame	1941	None
S4	Steel frame with cast-in-place concrete shear walls	1941	1976
S5	Steel frame with unreinforced masonry infill	1933	None
C1	Concrete moment-resisting frame	1933	1976
C2	Concrete shear wall	1941	1976
C3	Concrete frame with unreinforced masonry infill	1933	None
PC1	Tilt-up construction	1973	1997
PC2	Precast concrete frame	1941	None
RM1	Reinforced masonry with flexible floor and roof diaphragms	1933	1997
RM2	Reinforced masonry with rigid diaphragms	1933	1976
URM	Unreinforced masonry bearing-wall buildings	1933	N/A

*Not applicable in regions of low seismicity

2. Anchorage of Heavy Cladding

Year in which seismic anchorage requirements were adopted: 1967

3. Occupancy Loads

Use	**Square Feet, Per Person**	**Use**	**Square Feet, Per Person**
Assembly	varies, 10 minimum	Industrial	200-500
Commercial	50-200	Office	100-200
Emergency Services	100	Residential	100-300
Government	100-200	School	50-100

4. Score Modifier Definitions

Mid-Rise:	4 to 7 stories
High-Rise:	8 or more stories
Vertical Irregularity:	Steps in elevation view; inclined walls; building on hill; soft story (e.g., house over garage); building with short columns; unbraced cripple walls.
Plan Irregularity	Buildings with re-entrant corners (L, T, U, E, + or other irregular building plan); buildings with good lateral resistance in one direction but not in the other direction; eccentric stiffness in plan, (e.g. corner building, or wedge-shaped building, with one or two solid walls and all other walls open).
Pre-Code:	Building designed and constructed prior to the year in which seismic codes were first adopted and enforced in the jurisdiction; use years specified above in Item 1; default is 1941, except for PC1, which is 1973.
Post-Benchmark:	Building designed and constructed after significant improvements in seismic code requirements (e.g., ductile detailing) were adopted and enforced; the benchmark year when codes improved may be different for each building type and jurisdiction; use years specified above in Item 1 (see Table 2-2 of FEMA 154 *Handbook* for additional information).
Soil Type C:	Soft rock or very dense soil; S-wave velocity: 1200 – 2500 ft/s; blow count > 50; or undrained shear strength > 2000 psf.
Soil Type D:	Stiff soil; S-wave velocity: 600 – 1200 ft/s; blow count: 15 – 50; or undrained shear strength: 1000 – 2000 psf.
Soil Type E:	Soft soil; S-wave velocity < 600 ft/s; or more than 100 ft of soil with plasticity index > 20, water content > 40%, and undrained shear strength < 500 psf.

Figure 5-3 Quick Reference Guide for Anyplace USA showing entries for years in which seismic codes were first adopted and enforced and benchmark years.

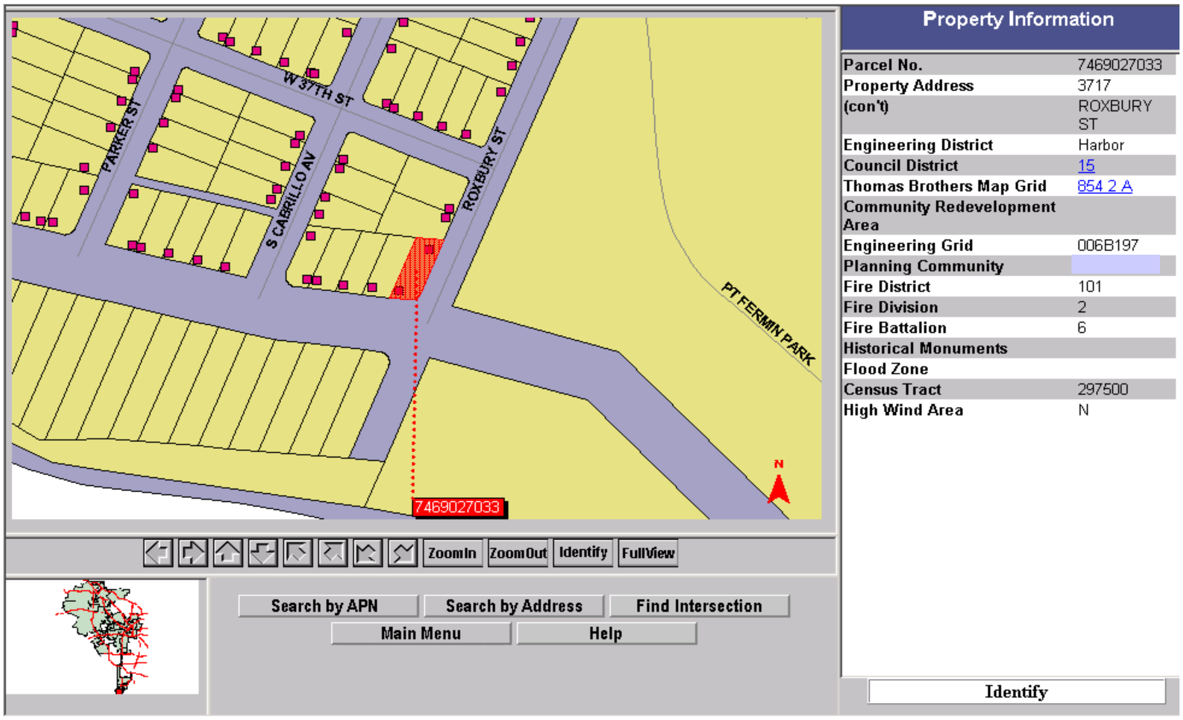


Figure 5-4 Property information at example site in city's geographic information system.

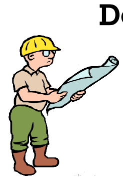
use in the GIS, the street addresses were subdivided into the following fields: the numeric part of the address; the street prefix (for example, "North"); the street name; and the street suffix (for example, "Drive"). A zip code field was added, zip codes for each street address were obtained using zip code lists available from the US Postal Service, and these data were also added to the database. This process yielded 950 street addresses, with parcel number and zip code, andestablished the initial information in Anyplace's electronic "Building RVS Database".

Permitting files, which contained data on buildings constructed or remodeled within the last 30 years (including parcel number), were then reviewed to obtain information on building name (if available), use, building height (height in feet and number of stories), total floor area, age (year built), and structural system. This process yielded information (from paper file folders) on approximately 500 buildings. Fields were added to the Building RVS Database for each of these attributes and data were added to the appropriate records (searching on parcel number) in the database; in the case of structure type, the entry included an asterisk to denote uncertainty. If an address was missing in the database, a new record containing that address and related data was added. On average, 30 minutes per building were required to extract the correct information from the permitting files and insert it into the electronic database.

The city's librarian provided copies of available Sanborn maps, which were reviewed to identify information on number of stories, year built, building size (square footage), building use, and limited information on structural type for approximately 200 buildings built prior to 1960. These data were added to the appropriate record (searching on address) in the Building RVS Database; in the case of structure type, the entry included an asterisk to denote uncertainty. If an address was missing in the database, a new record containing that address and related data was added. For this effort, 45 minutes per building, on average, were required to extract the correct information from the Sanborn maps and insert it into the electronic database.During the pre-field data collection and review process the RVS authority also obtained an electronic file of soils data (characterized in terms of the soil types described in Section 2.6.6) from the State Geologist and created an overlay of this information in the city's GIS system. Points defined by the addresses in the GIS reference tables (including newly identified addresses added to the references tables as a result of the above-cited efforts) were combined with the soils type overlay, and soil type was then assigned to each point (address) by a standard GIS operating procedure. The soils type information for each address was then transferred back to the Building RVS Database table into a new field for each building's soil type.

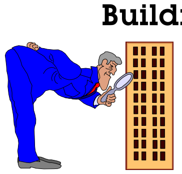
Based on the above efforts, Anyplace's Building RVS Database was expanded to include approximately 1,000 records with address, parcel number, zip code, and soils information, and approximately 700 of these records also contained information on building name (if any), use, number of stories, total floor area, year built, and structure type.

5.6 Step 6: Review of Construction Documents



Fortuitously, the city had retained microfilm copies of building construction documents submitted with each permit filing during the last 30 years, and copies of these documents were available for 500 buildings (the same subset described in Step 5 above). Teams consisting of one building department staff member and one consulting engineer reviewed these documents to verify, or identify, the lateral-force-resisting system for each building. Any new or revised information on structure type derived as part of this process was then inserted in the Building RVS Database, in which case, previously existing information in this field, along with the associated asterisk denoting uncertainty, was removed. On average, this effort required approximately 30 minutes per plan set, including database corrections.

5.7 Step 7: Field Screening of Buildings



Immediately prior to field screening (that is, at the conclusion of Step 6 above), the RVS authority acquired an electronic template of the Data Collection Form from the web site of the Applied Technology Council (www.atcouncil.org) and used this template to create individual Data Collection Forms for each record in the Building RVS Database. Each form contained unique information in the building identification portion of the form, with "Parcel Number" shown as "Other Identifiers" information (see Figure 5-2). In those instances where structure type information was included in the database, this information was also added as "Other Identifiers" information, with an asterisk if still uncertain. Soil type information was indicated on each form by circling the appropriate letter (and brief description) in the "Soil Type" section of the form (see Figure 5-2).

The Data Collection Forms, including blank forms for use with buildings not yet in the Building RVS Database, were distributed to the RVS screeners along with their RVS assignments (on a block-by-block basis). Screeners were advised that some of the database information printed on the form (e.g., number of stories, structure type denoted with an *) would need to be verified in the field, that approximately 700 of the 1,000 Data Collection Forms had substantially complete, but not necessarily verified, information in the location portion of the form, and that all 1,000 forms had street, address, parcel number, zip code, and soil type information.

Prior to field work, each screener was reminded to complete the Data Collection Form at each site before moving on to the next site, including adding his or her name as the screener and the screening date (in the building identification section of the form).

Following are several examples illustrating rapid visual screening in the field and completion of the Data Collection Form. Some examples use forms containing relatively complete building identification information, including structure type, obtained during the pre-field data acquisition and review process (Step 5); others use forms containing less complete building identification information; and still others use blank forms completely filled in at the site.

Example 1: 3703 Roxbury Street

Upon arriving at the site the screeners observed the building as a whole (Figure 5-5) and began the process of verifying the information in the building identification portion of the form (upper right corner), starting with the street address. The building's lateral-force-resisting system (S2, steel braced frame) was verified by looking at the building with binoculars (see Figure 5-6). The number of stories (10), use (office), and year built (1986) were also confirmed by inspection. The base dimensions of the building were estimated by pacing off the distance along each face, assuming 3 feet per stride, resulting in the determination that it was 75 ft x 100 ft in plan.

Figure 5-5 Exterior view of 3703 Roxbury Street.

On this basis, the listed square footage of 76,000 square feet was verified as correct (see Figure 5-7). The screeners also added their names and the date of the field screening to the building identification portion of the form.

A sketch of the plan and elevation views of the building were drawn in the “Sketch” portion of the form.

The building use was circled in the “Occupancy” portion, and from Section 3 of the Quick Reference Guide, the occupancy load was estimated at 75,000/150 = 500. Hence, the occupancy range of 101-1000 was circled.

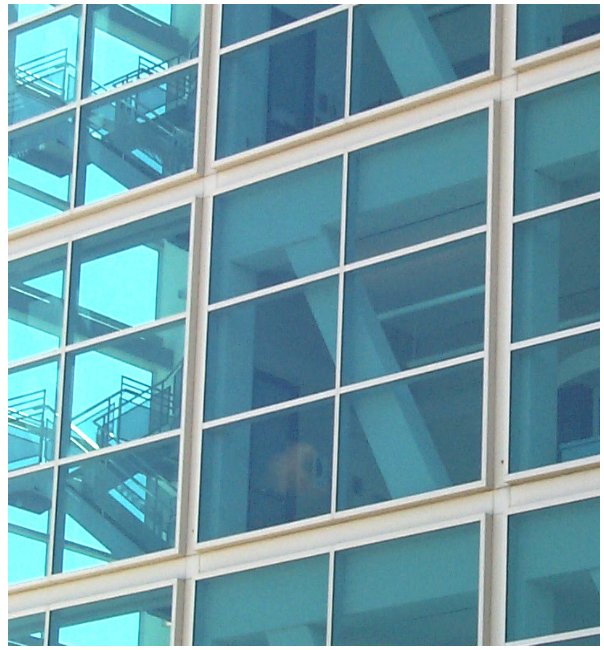
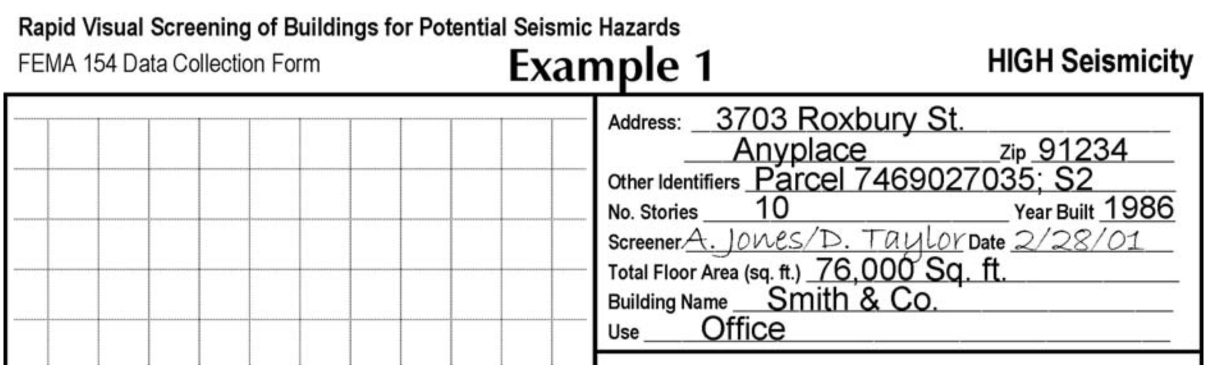


Figure 5-6 Close-up view of 3703 Roxbury Street exterior showing perimeter braced steel framing.

No falling hazards were observed, as glass cladding is not considered as heavy cladding.

The next step in the process was to circle the appropriate Basic Structural Hazard Score and the appropriate Score Modifiers. Having verified the lateral-force-resisting system as S2, this code was circled along with the Basic Structural Score beneath it (see Figure 5-8). Because the building is high rise (8 stories or more) this modifier was circled. Noting that the soil is type D, as already determined during the pre-field data acquisition phase and indicated in the Soil Type portion of the form, the modifier for Soil Type D was circled. By adding the column of circled numbers, a Final Score of 3.2 was determined. Because this score was greater than the cut-off score of 2.0, the building did not require a detailed evaluation by an experienced seismic design professional. Lastly, an instant camera photo of the building was attached to the form.



Rapid Visual Screening of Buildings for Potential Seismic Hazards
FEMA 154 Data Collection Form
Example 1
HIGH Seismicity

Address: 3703 Roxbury St.
Anyplace Zip 91234
Other Identifiers Parcel 7469027035; S2
No. Stories 10 Year Built 1986
Screener A. Jones/D. Taylor Date 2/28/01
Total Floor Area (sq. ft.) 76,000 Sq. ft.
Building Name Smith & Co.
Use Office

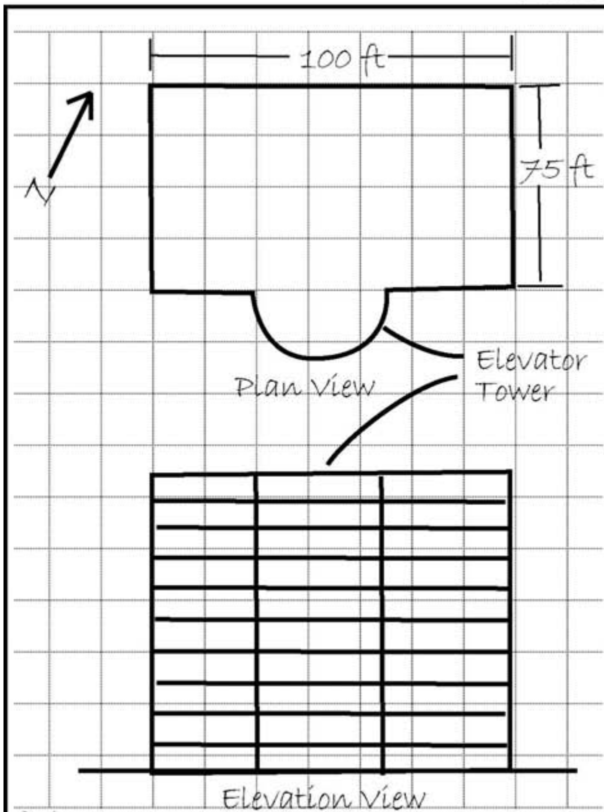
Figure 5-7 Building identification portion of Data Collection Form for Example 1, 3703 Roxbury Street.

Rapid Visual Screening of Buildings for Potential Seismic Hazards

FEMA-154 Data Collection Form

Example 1

HIGH Seismicity



Scale:

Address: 3703 Roxbury St.
Anyplace **Zip** 91234
Other Identifiers Parcel 7469027035; S2
No. Stories 10 **Year Built** 1986
Screener A. Jones/D. Taylor **Date** 2/28/01
Total Floor Area (sq. ft.) 76,000 Sq. ft.
Building Name Smith & Co.
Use Office

OCCUPANCY			SOIL						TYPE	FALLING HAZARDS			
Assembly Commercial Emer. Services	Govt Historic Industrial	Office Residential School	Number of Persons 0 – 10 11 – 100 101-1000 1000+	A Hard Rock	B Avg. Rock	C Dense Soil	D Stiff Soil	E Soft Soil	F Poor Soil	☐ Unreinforced Chimneys	☐ Parapets	☐ Cladding	☐ Other:

BASIC SCORE, MODIFIERS, AND FINAL SCORE, S

BUILDING TYPE	W1	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM
Basic Score	4.4	3.8	2.8	3.0	3.2	2.8	2.0	2.5	2.8	1.6	2.6	2.4	2.8	2.8	1.8
Mid Rise (4 to 7 stories)	N/A	N/A	+0.2	+0.4	N/A	+0.4	+0.4	+0.4	+0.4	+0.2	N/A	+0.2	+0.4	+0.4	0.0
High Rise (> 7 stories)	N/A	N/A	+0.6	+0.8	N/A	+0.8	+0.8	+0.6	+0.8	+0.3	N/A	+0.4	N/A	+0.6	N/A
Vertical Irregularity	-2.5	-2.0	-1.0	-1.5	N/A	-1.0	-1.0	-1.5	-1.0	-1.0	N/A	-1.0	-1.0	-1.0	-1.0
Plan irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Pre-Code	0.0	-1.0	-1.0	-0.8	-0.6	-0.8	-0.2	-1.2	-1.0	-0.2	-0.8	-0.8	-1.0	-0.8	-0.2
Post-Benchmark	+2.4	+2.4	+1.4	+1.4	N/A	+1.6	N/A	+1.4	+2.4	N/A	+2.4	N/A	+2.8	+2.6	N/A
Soil Type C	0.0	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Soil Type D	0.0	-0.8	-0.6	-0.6	-0.6	-0.6	-0.4	-0.6	-0.6	-0.4	-0.6	-0.6	-0.6	-0.6	-0.6
Soil Type E	0.0	-0.8	-1.2	-1.2	-1.0	-1.2	-0.8	-1.2	-0.8	-0.8	-0.4	-1.2	-0.4	-0.6	-0.8
FINAL SCORE, S				3.2											

COMMENTS

Detailed Evaluation Required

YES **NO**

* = Estimated, subjective, or unreliable data
DNK = Do Not Know

BR = Braced frame
FD = Flexible diaphragm
LM = Light metal

MRF = Moment-resisting frame
RC = Reinforced concrete
RD = Rigid diaphragm

SW = Shear wall
TU = Tilt up
URM INF = Unreinforced masonry infill

Figure 5-8 Completed Data Collection Form for Example 1, 3703 Roxbury Street.

Example 2: 3711 Roxbury Street

Upon arrival at the site, the screeners observed the building as a whole (Figure 5-9). Unlike Example 1, there was little information in the building identification portion of the form (only street address, zip code, and parcel number were provided). The screeners determined the number of stories to be 12 and the building use to be commercial and office. They paced off the building plan dimensions to estimate the plan size to be 58 feet x 50 feet. Based on this information, the total square footage was estimated to be 34,800 square feet (12 x 50 x 58), and the number of stories, use, and square footage were written on the form. Based on a review of information in Appendix D of this *Handbook*, the year of construction was estimated to be 1944 and this date was written on the form.

A sketch of the plan and elevation views of the building were drawn in the "Sketch" portion of the form.

The building use was circled in the "Occupancy" portion, and from Section 3 of the Quick Reference Guide, the occupancy load was estimated at 34,800/135♦ = 258. Hence, the occupancy range of 101-1000 was circled.

The cornices at roof level were observed, and entered on the form.

Noting that the estimated construction date was 1944 and that it was a 12-story building , a review of the material in Table D-6 (Appendix D), indicated that the likely options for building type were S1, S2, S5, C1, C2, or C3. On more careful examination of the building exterior with the use of binoculars (see Figure 5-10), it was determined the building was type C3, and this alpha-numeric code, and accompanying Basic Structural Score, were circled on the Data Collection Form.

Because the building was high-rise (more than 7 stories), this modifier was circled, and because the four individual towers extending above the base represented a vertical irregularity, this modifier was circled. Noting that the soil is type D, as already determined during the pre-field data acquisition phase and indicated in the Soil Type portion of the form, the modifier for Soil Type D was circled.

By adding the column of circled numbers, a Final Score of 0.5 was determined. Because this score was less than the cut-off score of 2.0, the building required a detailed evaluation by an experienced seismic design professional. Lastly, an instant camera photo of the building was attached to the Data Collection Form (a completed version of the form is provided in Figure 5-11).

♦ The "135" value is the approximate average of the mid-range occupancy load for commercial buildings (125 sq. ft. per person) and the mid-range occupancy load for office buildings (150 sq. ft. per person).

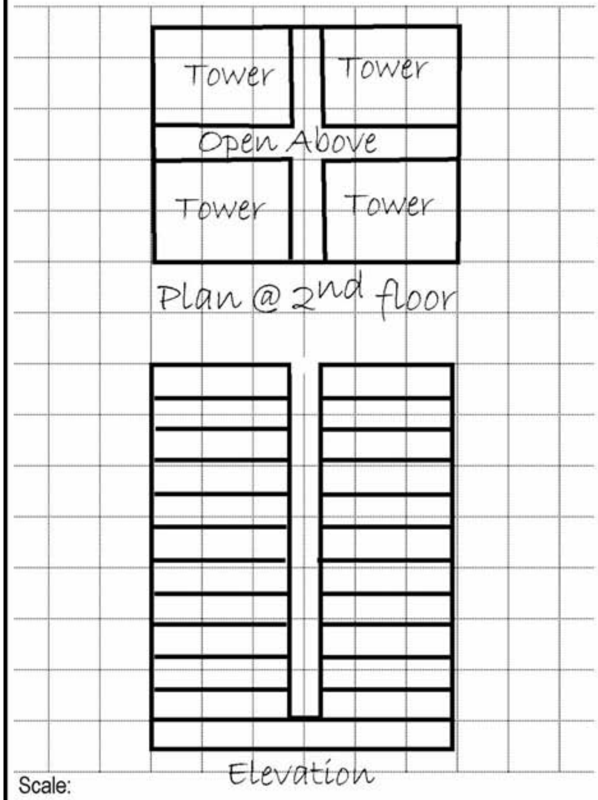
Figure 5-9 Exterior view of 3711 Roxbury.

Figure 5-10 Close-up view of 3711 Roxbury Street building exterior showing infill frame construction.

Rapid Visual Screening of Buildings for Potential Seismic Hazards
FEMA-154 Data Collection Form

Example 2

HIGH Seismicity



Scale:

Address: 3711 Roxbury St.
Anyplace Zip 91234
Other Identifiers Parcel 7469027034
No. Stories 12 Year Built 1944
Screener A. Jones/D. Taylor Date 2/28/01
Total Floor Area (sq. ft.) 34,800
Building Name
Use Commercial and Offices above

OCCUPANCY: Assembly, Commercial, Emer. Services, Govt, Historic, Industrial, Office, Residential, School

Number of Persons: 0 – 10, 11 – 100, 101-1000, 1000+

SOIL — **TYPE**: A Hard Rock; B Avg. Rock; C Dense Soil; D Stiff Soil; E Soft Soil; F Poor Soil

FALLING HAZARDS: ☐ Unreinforced Chimneys; ☐ Parapets; ☐ Cladding; ☒ Other: Cornices

BASIC SCORE, MODIFIERS, AND FINAL SCORE, S

BUILDING TYPE	W1	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM
Basic Score	4.4	3.8	2.8	3.0	3.2	2.8	2.0	2.5	2.8	1.6	2.6	2.4	2.8	2.8	1.8
Mid Rise (4 to 7 stories)	N/A	N/A	+0.2	+0.4	N/A	+0.4	+0.4	+0.4	+0.4	+0.2	N/A	+0.2	+0.4	+0.4	0.0
High Rise (> 7 stories)	N/A	N/A	+0.6	+0.8	N/A	+0.8	+0.8	+0.6	+0.8	+0.3	N/A	+0.4	N/A	+0.6	N/A
Vertical Irregularity	-2.5	-2.0	-1.0	-1.5	N/A	-1.0	-1.0	-1.5	-1.0	-1.0	N/A	-1.0	-1.0	-1.0	-1.0
Plan irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Pre-Code	0.0	-1.0	-1.0	-0.8	-0.6	-0.8	-0.2	-1.2	-1.0	-0.2	-0.8	-0.8	-1.0	-0.8	-0.2
Post-Benchmark	+2.4	+2.4	+1.4	+1.4	N/A	+1.6	N/A	+1.4	+2.4	N/A	+2.4	N/A	+2.8	+2.6	N/A
Soil Type C	0.0	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Soil Type D	0.0	-0.8	-0.6	-0.6	-0.6	-0.6	-0.4	-0.6	-0.6	-0.4	-0.6	-0.6	-0.6	-0.6	-0.6
Soil Type E	0.0	-0.8	-1.2	-1.2	-1.0	-1.2	-0.8	-1.2	-0.8	-0.8	-0.4	-1.2	-0.4	-0.6	-0.8
FINAL SCORE, S										0.5					

COMMENTS

Detailed Evaluation Required
YES **NO**

* = Estimated, subjective, or unreliable data
DNK = Do Not Know
BR = Braced frame
FD = Flexible diaphragm
LM = Light metal
MRF = Moment-resisting frame
RC = Reinforced concrete
RD = Rigid diaphragm
SW = Shear wall
TU = Tilt up
URM INF = Unreinforced masonry infill

Figure 5-11 Completed Data Collection Form for Example 2, 3711 Roxbury Street.

Example 3: 5020 Ebony Drive

Example 3 was a high-rise residential building (Figure 5-12) in a new part of the city in which new development had begun within the last few years. The building was not included in the electronic Building RVS Database, and consequently there was not a partially prepared Data Collection Form for this building. Based on visual inspection, the screeners determined that the building had 22 stories, including a tall-story penthouse, estimated that it was designed in 1996, and concluded that its use was both commercial (in the first story) and residential in the upper stories. The screeners paced off the building plan dimensions to estimate the plan size to be approximately 270 feet x 180 feet. Based on this information and considering the symmetric but non-rectangular floor plan, the total square footage was estimated to be 712,800 square feet. These data were written on the form, along with the names of the screeners and the date of the screening. The screeners also drew a sketch of a portion of the plan view of the building in the space on the form allocated for a "Sketch".

The building use (commercial and residential) was circled in the "Occupancy" portion, and from Section 3 of the Quick Reference Guide, the occupancy load was estimated at 712,800/200 = 3,564. Based on this information, the occupancy range of 1000+ was circled.

While the screeners reasonably could have assumed a type D soil, which was the condition at the adjacent site approximately ½ mile away, they concluded they had no basis for assigning a soil type. Hence they followed the instructions in the *Handbook* (Section 3.4), which specifies that if there is no basis for assigning a soil type, soil type E should be assumed. Accordingly, this soil type was circled on the form.

Given the design date of 1996, the anchorage for the heavy cladding on the exterior of the building was assumed to have been designed to meet the anchorage requirements initially adopted in 1967 (per the information on the Quick Reference Guide). No other falling hazards were observed.

The window spacing in the upper stories and the column spacing at the first floor level indicated the building was either a steel moment-frame building, or a concrete moment-frame building. The screeners attempted to view the interior but were not provided with permission to do so. They elected to indicate that the building was either an S1 or C1 type on the Data Collection Form and circled both types, along with their Basic Structural Scores. In addition, the screeners circled the modifiers for high rise (8 stories or more) and post-benchmark year, given that the estimated design date (1996) occurred after the benchmark years for both S1 and C1 building types (per the information on the Quick Reference Guide). They also circled the modifier for soil type E (in both the S1 and C1 columns).

Figure 5-12 Exterior view of 5020 Ebony Drive.

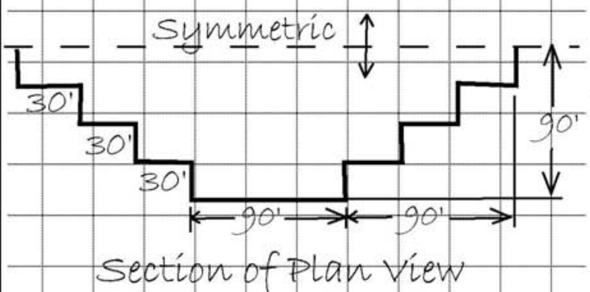
By adding the circled numbers in both the S1 and C1 columns, Final Scores of 3.6 and 3.3 respectively were determined for the two building types. Because both scores were greater than the cut-off score of 2.0, a detailed evaluation of the building by an experienced seismic design professional was not required. Before leaving the site, the screeners photographed the building and attached the photo to the Data Collection Form. A completed version of the Data Collection Form is provided in Figure 5-13.

Rapid Visual Screening of Buildings for Potential Seismic Hazards

FEMA-154 Data Collection Form

Example 3

HIGH Seismicity



Scale:

Address: 5020 Ebony Drive
Anyplace **Zip** 91011
Other Identifiers
No. Stories 22 **Year Built** 1996
Screener A. Jones/D. Taylor **Date** 2/28/01
Total Floor Area (sq. ft.) 712,800
Building Name
Use Residential and Commercial

OCCUPANCY

~~Assembly~~	Govt	~~Office~~
Commercial	Historic	Residential
Emer. Services	Industrial	~~School~~

Number of Persons: 0 – 10; ~~11 – 100~~; 101-1000; 1000+

SOIL

TYPE

A	B	C	D	E	F
Hard Rock	Avg. Rock	Dense Soil	Stiff Soil	Soft Soil	Poor Soil

FALLING HAZARDS

☐ Unreinforced Chimneys ☐ Parapets ☐ Cladding ☐ Other:

BASIC SCORE, MODIFIERS, AND FINAL SCORE, *S*

BUILDING TYPE	W1	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM
Basic Score	4.4	3.8	2.8	3.0	3.2	2.8	2.0	2.5	2.8	1.6	2.6	2.4	2.8	2.8	1.8
Mid Rise (4 to 7 stories)	N/A	N/A	+0.2	+0.4	N/A	+0.4	+0.4	+0.4	+0.4	+0.2	N/A	+0.2	+0.4	+0.4	0.0
High Rise (> 7 stories)	N/A	N/A	+0.6	+0.8	N/A	+0.8	+0.8	+0.6	+0.8	+0.3	N/A	+0.4	N/A	+0.6	N/A
Vertical Irregularity	-2.5	-2.0	-1.0	-1.5	N/A	-1.0	-1.0	-1.5	-1.0	-1.0	N/A	-1.0	-1.0	-1.0	-1.0
Plan irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Pre-Code	0.0	-1.0	-1.0	-0.8	-0.6	-0.8	-0.2	-1.2	-1.0	-0.2	-0.8	-0.8	-1.0	-0.8	-0.2
Post-Benchmark	+2.4	+2.4	+1.4	+1.4	N/A	+1.6	N/A	+1.4	+2.4	N/A	+2.4	N/A	+2.8	+2.6	N/A
Soil Type C	0.0	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Soil Type D	0.0	-0.8	-0.6	-0.6	-0.6	-0.6	-0.4	-0.6	-0.6	-0.4	-0.6	-0.6	-0.6	-0.6	-0.6
Soil Type E	0.0	-0.8	-1.2	-1.2	-1.0	-1.2	-0.8	-1.2	-0.8	-0.8	-0.4	-1.2	-0.4	-0.6	-0.8
FINAL SCORE, *S*			3.6					3.3							

COMMENTS

Screeners could not determine if building type was C1 or S1; hence both types were scored, with similar results.

Detailed Evaluation Required

YES **NO**

* = Estimated, subjective, or unreliable data
DNK = Do Not Know

BR = Braced frame
FD = Flexible diaphragm
LM = Light metal

MRF = Moment-resisting frame
RC = Reinforced concrete
RD = Rigid diaphragm

SW = Shear wall
TU = Tilt up
URM INF = Unreinforced masonry infill

Figure 5-13 Completed Data Collection Form for Example 3, 5020 Ebony Drive.

Figure 5-14 Exterior view of 1450 Addison Avenue.

Example 4: 1450 Addison Avenue

The building at 1450 Addison Avenue (see Figure 5-14) was a 1-story commercial building designed in 1990, per the information provided in the building identification portion of the Data Collection Form. By inspection the screeners confirmed the address, number of stories, use (commercial), and year built (Figure 5-15). The screeners paced off the building plan dimensions to estimate the plan size (estimated to be 10,125 square feet), confirming the square footage shown on the identification portion of the form. The L-shaped building was drawn on the form, along with the dimensions of the various legs.

The building's commercial use was circled in the "Occupancy" portion, and from Section 3 of the Quick Reference Guide, the occupancy load was estimated at 10,200/125 = 80. Hence, the occupancy range of 11-100 was circled. No falling hazards were observed.

The building type (W2) was circled on the form along with its Basic Structural Score. Because the building was L-shaped in plan the modifier for plan irregularity was circled. Because soil type C had been circled in the Soil Type box (based on the information in the Building RVS Database) the modifier for soil type C was circled.

By adding the column of circled numbers, a Final Score of 5.3 was determined. Because this score was greater than the cut-off score of 2.0, the building did not require a detailed evaluation by an experienced seismic design professional. Lastly, an instant camera photo of the building was attached to the Data Collection Form. A completed version of the form is provided in Figure 5-16.

Rapid Visual Screening of Buildings for Potential Seismic Hazards

FEMA 154 Data Collection Form **Example 4** **HIGH Seismicity**

Address: 1450 Addison Avenue
Anyplace Zip 91230
Other Identifiers Parcel 16287654958
No. Stories 1 Year Built 1990
Screener A. Jones/D. Taylor Date 2/28/01
Total Floor Area (sq. ft.) 10,200
Building Name
Use Commercial

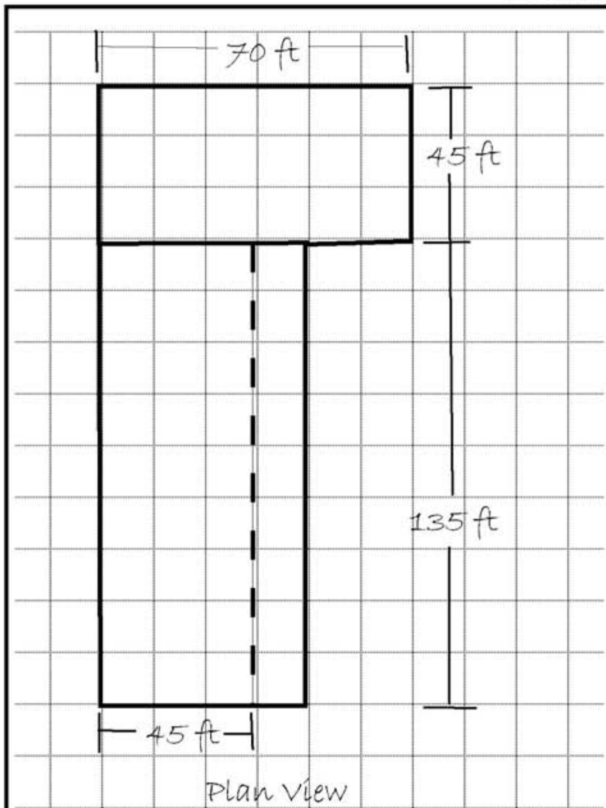
Figure 5-15 Building identification portion of Data Collection Form for Example 4, 1450 Addison Avenue.

Rapid Visual Screening of Buildings for Potential Seismic Hazards

FEMA-154 Data Collection Form

Example 4

HIGH Seismicity



Scale:

Address: 1450 Addison Avenue
Anyplace Zip 91230
Other Identifiers Parcel 16287654958
No. Stories 1 Year Built 1990
Screener A. Jones/D. Taylor Date 2/28/01
Total Floor Area (sq. ft.) 10,200
Building Name
Use Commercial

OCCUPANCY			SOIL						TYPE	FALLING HAZARDS			
Assembly	Govt	Office	Number of Persons	A Hard Rock	B Avg. Rock	C Dense Soil	D Stiff Soil	E Soft Soil	F Poor Soil	Unreinforced Chimneys	Parapets	Cladding	Other:
Commercial	Historic	Residential	0 – 10 / 11 – 100										
Emer. Services	Industrial	School	101-1000 / 1000+										

BASIC SCORE, MODIFIERS, AND FINAL SCORE, S

BUILDING TYPE	W1	W2	S1 (MRF)	S2 (BR)	S3 (LM)	S4 (RC SW)	S5 (URM INF)	C1 (MRF)	C2 (SW)	C3 (URM INF)	PC1 (TU)	PC2	RM1 (FD)	RM2 (RD)	URM
Basic Score	4.4	3.8	2.8	3.0	3.2	2.8	2.0	2.5	2.8	1.6	2.6	2.4	2.8	2.8	1.8
Mid Rise (4 to 7 stories)	N/A	N/A	+0.2	+0.4	N/A	+0.4	+0.4	+0.4	+0.4	+0.2	N/A	+0.2	+0.4	+0.4	0.0
High Rise (> 7 stories)	N/A	N/A	+0.6	+0.8	N/A	+0.8	+0.8	+0.6	+0.8	+0.3	N/A	+0.4	N/A	+0.6	N/A
Vertical Irregularity	-2.5	-2.0	-1.0	-1.5	N/A	-1.0	-1.0	-1.5	-1.0	-1.0	N/A	-1.0	-1.0	-1.0	-1.0
Plan irregularity	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Pre-Code	0.0	-1.0	-1.0	-0.8	-0.6	-0.8	-0.2	-1.2	-1.0	-0.2	-0.8	-0.8	-1.0	-0.8	-0.2
Post-Benchmark	+2.4	+2.4	+1.4	+1.4	N/A	+1.6	N/A	+1.4	+2.4	N/A	+2.4	N/A	+2.8	+2.6	N/A
Soil Type C	0.0	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Soil Type D	0.0	-0.8	-0.6	-0.6	-0.6	-0.6	-0.4	-0.6	-0.6	-0.4	-0.6	-0.6	-0.6	-0.6	-0.6
Soil Type E	0.0	-0.8	-1.2	-1.2	-1.0	-1.2	-0.8	-1.2	-0.8	-0.8	-0.4	-1.2	-0.4	-0.6	-0.8
FINAL SCORE, S		5.3													

COMMENTS

Detailed Evaluation Required

YES NO

* = Estimated, subjective, or unreliable data
DNK = Do Not Know

BR = Braced frame
FD = Flexible diaphragm
LM = Light metal

MRF = Moment-resisting frame
RC = Reinforced concrete
RD = Rigid diaphragm

SW = Shear wall
TU = Tilt up
URM INF = Unreinforced masonry infill

Figure 5-16 Completed Data Collection Form for Example 4, 1450 Addison Avenue.

5.8 Step 8: Transferring the RVS Field Data to the Electronic Building RVS Database

The last step in the implementation of rapid visual screening for Anyplace USA was transferring the information on the RVS Data Collection Forms into the relational electronic Building RVS Database. This required that all photos and sketches on the forms be scanned and numbered (for reference purposes), and that additional fields (and tables) be added to the database for those attributes not originally included in the database.

For quality control purposes, data were entered separately into two different versions of the electronic database, except photographs and sketches, which were scanned only once. A double-entry data verification process was then used, whereby the data from one database were compared to the same entries in the second database to identify those entries that were not exactly the same. Non-identical entries were examined and corrected as necessary. The entire process, including scanning of sketches and photographs, required approximately 45 minutes per Data Collection Form.

After the electronic Building RVS Database was verified, it was imported into the city's GIS, thereby providing Anyplace with a state-of-the-art capability to identify and plot building groups based on any set of criteria desired by the city's policy makers. Photographs and sketches of individual buildings could also be shown in the GIS simply by clicking on the dot or symbol used to represent each building and selecting the desired image.